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DoE Nuclear Initiatives

Maintaining Nuclear Deterrence in the 21st Century

Executive Summary

- The U.S. nuclear infrastructure provided a credible nuclear deterrent force during the Cold War, but it must be modified if it is to provide a deterrence against adversaries in the 21st century.

- To be able to adapt to current and emerging threats, the U.S. nuclear infrastructure must be "responsive," requiring: 1) increased confidence that deployed nuclear forces will work as designed; 2) development of new concepts to match new realities; 3) elimination of old, unreliable, and unneeded nuclear weapons; and 4) mitigation of unforeseen technological problems in the nuclear infrastructure.

- Nuclear weapons in the current stockpile undergo an "aging" process that affects their safety, reliability, and performance. Meanwhile, with no new warheads being designed, old weapons are expected to remain operational for many decades and perform exactly as designed, despite outlasting their original service-life estimates.

- The President's Nuclear Posture Review determined that now is the time to reconsider current capabilities and explore how best to mitigate aging effects in the stockpile so that the United States can maintain a credible deterrence against current and future adversaries in this century.

- To ensure the responsiveness of the nuclear infrastructure, the Bush Administration included initiatives in its FY06 Department of Energy budget to establish and maintain such programs as, the Reliable Replacement Warhead (RRW), pit manufacturing, Robust Nuclear Earth Penetrator (RNEP), and test readiness.

- The DoE initiatives lay the ground work for a safe, reliable, and *credible* nuclear deterrent force for the 21st century.

- Congressional support of these nuclear initiatives is critical to U.S. national security in the 21st century. Due to the technical complexity of the DoE initiatives, Congress cannot wait until a crisis in readiness and reliability is upon the United States – it will be too late.

Introduction

The U.S. nuclear infrastructure provided a credible nuclear deterrent force during the Cold War, but it must be modified if it is to provide a deterrence against adversaries in the 21st century. The unfortunate reality of today's world is that the current and likely future strategic environments will require the United States to maintain nuclear weapons to deter – and if necessary defeat – would-be adversaries. Recognizing this, the Nuclear Posture Review, conducted by the Bush Administration in late 2001, set a new direction for U.S. nuclear forces to ensure the United States would have a safe, reliable nuclear force to address these realities.

To be able to adapt to current and emerging threats, the U.S. nuclear infrastructure must be "responsive," requiring: 1) increased confidence that deployed nuclear forces will work as designed; 2) development of new concepts to match new realities; 3) elimination of old, unreliable, and unneeded nuclear weapons; and 4) mitigation of unforeseen technological problems in the nuclear infrastructure. Yet, since 1989, no new nuclear warheads have been built, and existing weapons are expected to remain operational for many decades and perform exactly as designed despite outlasting original service-life estimates.

The Bush Administration included measures in its FY06 Department of Energy budget to ensure the responsiveness of the nuclear infrastructure. Some of the key initiatives in the current budget include: the Reliable Replacement Warhead (RRW); pit manufacturing (shell of plutonium and other components in warheads); Robust Nuclear Earth Penetrator (RNEP); and test readiness.

This paper will address: 1) the requirements to maintain a credible nuclear deterrent force; and 2) the importance of the initiatives included in the DoE budget in maintaining that deterrence.

Maintaining Deterrence

Deterrence, as a component of military strategy, is certainly not a concept confined to nuclear deterrence. At its simplest, as defined by the Department of Defense (DoD), deterrence is "the prevention from action by fear of the consequences. Deterrence is a state of mind brought about by the existence of a credible threat of unacceptable counteraction."[1]

As noted by the Strategic Deterrence Joint Operating Concept published in February 2004:

> The objective of strategic deterrence is to convince potential adversaries that courses of action that threaten U.S. vital interests will result in outcomes that are decisively worse than they could achieve through alternative courses of action available to them. Strategic deterrence achieves this objective by decisively influencing an adversary's decision calculus.[2]

Deterrence in practice is not a static concept. The key to maintaining deterrence is to present a credible threat of unacceptable counteraction. Yet, the tools necessary to present what

[1] DoD Dictionary. Available at: http://www.dtic.mil/doctrine/jel/doddict/.
[2] Department of Defense, "Strategic Deterrence Joint Operating Concept," February 2004.

adversaries view as a credible threat can differ in various situations. In addition, the actions one seeks to prevent are not constant.

The United States' ability to deter adversaries from unacceptable courses of action rests on a wide range of military, diplomatic, and economic tools. U.S. nuclear deterrent forces comprise a fundamental part of that strategic deterrence. As the Joint Operating Concept notes, "U.S. nuclear forces contribute uniquely and fundamentally to strategic deterrence – through their ability to impose costs and deny benefits to an adversary in an exceedingly rapid and devastating manner no adversary can counter."[3]

Cold War Nuclear Deterrence Calculations

During the Cold War, deterrence constituted a cornerstone of the U.S. strategy of containment aimed at countering the expansion of the Soviet Union. The size and scope of U.S. nuclear forces were modified over the course of the Cold War to maintain the credibility of the threat of force needed to back U.S. policy objectives. The fluctuations in U.S. containment policy – between symmetrical and asymmetrical response to the Soviet Union[4] – affected the U.S. reliance on nuclear weapons as a matter of degree, but did not raise the question of whether they should be unilaterally abandoned.

Policymakers had to decide what balance would best serve U.S. interests and security given available U.S. resources – nuclear, as well as diplomatic, economic, and conventional military resources. U.S. policymakers during the Cold War had to continually reevaluate what forces – nuclear and conventional – would credibly influence the Soviet Union's decision calculus.

New Nuclear Deterrence Calculations

The United States must now consider how to maintain a credible nuclear deterrent force in a more complex security environment. The current nuclear stockpile – designed to deter the Soviet Union – maintains a credible deterrent against attack on the United States by a resurgent Russia or an emerging China, but that credibility will fade if its reliability cannot be certified over time. The new security environment requires the United States to analyze whether the current nuclear stockpile presents an adequate deterrence to protect democratic allies from emerging nuclear superpowers. The presence of rogue regimes with nuclear ambitions also requires the United States to consider to what extent the existing nuclear force affects such regimes' decision calculus.

The President's Nuclear Posture Review determined that now is the time to reconsider current capabilities and explore how best to mitigate aging effects in the stockpile so that the

[3] Department of Defense, "Strategic Deterrence Joint Operating Concept."

[4] Symmetrical response – responding to threats in-kind; Asymmetrical response – responding to threats in method of one's own choosing. "Credibility, in an asymmetrical strategy, comes largely by threatening to use incredible weapons in the expectation that one will not actually have to do so: one risks escalation to achieve economy. Credibility, in a symmetrical strategy, comes by actually using less dangerous weapons on a limited scale: one sacrifices economy to avoid escalation. Obviously a symmetrical strategy makes military conflict more likely than an asymmetrical one; one has to weigh the costs, though, against the risks of not acting until the only options left are to 'go nuclear,' or to capitulate." (John Lewis Gaddis, *Strategies of Containment*, New York: Oxford University Press, p. 355)

United States can maintain a credible deterrence against current and future adversaries in this century. A responsive nuclear force guards against the following potential scenarios:

- **U.S. nuclear deterrence will fade if the nuclear stockpile becomes unreliable due to weapons' age or old design constraints.** As the U.S. nuclear stockpile ages past its expected service life, the certainty that the systems will work as designed gradually will become compromised. According to Ambassador Linton Brooks, Administrator of the National Nuclear Security Administration (NNSA), the current U.S. nuclear stockpile was not designed for longevity. During the Cold War nuclear weapons were retired and replaced by new weapons every 15 to 20 years. While such a policy made sense during the Cold War, it is becoming more difficult and more costly to certify the aging weapons despite the extraordinary success of the stockpile stewardship program. Ambassador Brooks noted, "The inevitable accumulation of small changes over the extended lifetime of these systems will increase uncertainty in long-term weapons performance."[5] If the United States does not take measures to ensure the reliability of the stockpile for the future, potential future adversaries may not view the U.S. nuclear deterrent force as credible and subsequently may become emboldened in their actions.

- **U.S. nuclear deterrence will fade if adversaries develop counters and defenses to static Cold War systems.** Deterrence is dependent on an intended target's vulnerability to the weapon systems one would use against that target. Bluntly, deterrence depends on the coercive ability of the "power to hurt" as the strategic theorist Thomas Schelling puts it.[6] Yet if our capability to coerce remains static, then potential adversaries will be incentivized to develop defenses that will lessen our ability to deter their actions. A clear example is the expansion of hard and deeply buried targets (HDBT) being developed by potential adversaries. General James E. Cartwright, Commander of U.S. Strategic Command, noted in a recent hearing, "I would say that this target set of varied and deeply-buried and hardened targets is a very real target set and that it is growing."[7] If adversaries perceive that they have sufficiently defended their interests, they may again be emboldened in their actions.

- **U.S. nuclear deterrence will fade if adversaries know use of certain weapons is off the table.** Strategic deterrence rests on a wide range of tools available to policymakers – a main component of which is nuclear deterrence. Policymakers must also have a range of nuclear capabilities available to maintain a credible nuclear deterrence. As noted in the Joint Operating Concept, "The most important limitation on [nuclear weapons'] cost imposition impact is the credibility of our willingness to use them in conflict. Clearly, this credibility is in large part a function of the threat magnitude that nuclear weapons use would counter. However, selective improvements and innovations in our nuclear capabilities could significantly enhance their use credibility."[8] Policymakers must still weigh the gravity of employing any weapon in the U.S. nuclear arsenal, but the presence of a range of U.S. capabilities is necessary to influence a potential adversary's decision calculus.

[5] In the absence of nuclear testing, the Department of Energy's (DoE) Stockpile Stewardship Program uses different experiments and tools to obtain data relevant to nuclear warhead performance as components within a warhead potentially change properties with age.
[6] Thomas C. Schelling, *Arms and Influence*, New Haven: Yale University Press, 1966, p. 4.
[7] General James E. Cartwright, in testimony before the Senate Armed Services Subcommittee on Strategic Forces, on April 4, 2005.
[8] Department of Defense, "Strategic Deterrence Joint Operating Concept."

Bush Administration Nuclear Initiatives

The Bush Administration has included a number of provisions in its FY06 budget request to ensure that the United States has a responsive nuclear infrastructure to provide deterrence against current and emerging adversaries.

Reliable Replacement Warhead

The purpose of the Reliable Replacement Warhead (RRW) program is to demonstrate the feasibility of developing reliable replacement components for the existing nuclear stockpile.[9] The initial focus will be to provide cost and schedule efficient replacement pits that can be certified *without* underground tests.[10] The RRW program is not currently intended to produce replacement warheads, but will look at whether, if design constraints imposed on Cold War systems are relaxed, replacements for existing weapons can be developed that can be more easily manufactured with more readily available and more environmentally benign materials.[11]

- **The RRW program helps maintain nuclear deterrence.** For deterrence to be credible, the weapons used must be reliable. The RRW program uses the knowledge gained by DoE on nuclear weapon component aging to develop safe, reliable replacement components that can employ technological advances in materials and design not available during the Cold War.

- **The RRW program allows for a further reduction in the size of the nuclear stockpile.** If the United States can ensure the reliability of its nuclear weapons, the need for very large numbers of weapons as a hedge against a failure in one portion of the stockpile is no longer necessary.

- **The RRW program reduces the likelihood that the U.S. will need to resume testing of nuclear weapons to ensure the safety, security, and reliability of the stockpile.** Warheads built during the Cold War were built with very tight performance margins – they were extremely complex designs for specific missions. The work of the Stockpile Stewardship Program has yielded a greater understanding of how the materials within nuclear weapons built to these tight constraints interact and change over time. New warheads could replace aging designs with more reliable materials and less complicated designs – decreasing the need to conduct nuclear tests to ensure weapons in the stockpile are safe and reliable.

- **The RRW program will help reduce the increasing costs associated with certification of aging nuclear weapons.** While the Stockpile Stewardship Program has been able to manage the aging stockpile thus far, it has become increasingly costly and technically challenging to do so. If research from the RRW demonstrates that it is possible within a decade to replace existing warheads, it will be possible to cease costly warhead life-extension programs.

[9] See the attached Appendix for background on the RRW program.
[10] Department of Energy, "FY2006 Congressional Budget Request: National Nuclear Security Administration," DOE/ME-0046, Volume 1.
[11] Ambassador Linton F. Brooks, Administrator of the National Nuclear Security Administration, in testimony before the Senate Armed Services Subcommittee on Strategic Forces, on April 4, 2005.

Pit Manufacturing

The DoE Pit Manufacturing and Certification Campaign has the goal of restoring capability and some limited capacity to manufacture nuclear pits of all types required for the nuclear weapon stockpile. The pits are shells of plutonium within a nuclear weapon. The energy released when the plutonium atoms fission, or split, helps to start the fusion explosion of a modern thermonuclear weapon. The initiative includes planning for the purpose of establishing a long-term responsive pit manufacturing infrastructure – referred to as the Modern Pit Facility (MPF).[12]

- **The DoE Pit Manufacturing and Certification Campaign addresses a limitation in stockpile maintenance.** Since 1989, the United States has been without the capability to produce stockpile-certified plutonium pits.[13] The United States is the only avowed nuclear weapons state that does not have the ability to replace existing pits or to build pits for new weapons. According to Secretary of Energy Samuel W. Bodman, "Stockpile pits are now approximately 15 to 35 years old and are reaching ages beyond DOE's previous experience. The end-of-life age limit for plutonium pits is not known, but is not unlimited (figures for estimated pit lifetime provided by the DOE nuclear weapons laboratories range from 45 to 60 years)."[14] Eventually, the radioactivity of the pit affects its physical structure, resulting at some point in serious age-related failures. If these age-related failures are not addressed, the reliability and safety of the aging warheads cannot be certified.

Robust Nuclear Earth Penetrator (RNEP)

Nuclear earth penetrator weapons burrow into the ground some tens of feet before detonating, greatly increasing their ability to destroy hardened underground targets.[15] The proposed study will consider the feasibility of a modification to existing bombs that can address the growing number of hard and deeply buried targets used by potential adversaries.[16] While the United States will continue to pursue alternatives with conventional weapons, some targets may only be vulnerable to nuclear earth penetrators.

- **The United States has a nuclear earth penetrator – the B61-11.** A point often overlooked by critics of the RNEP study is that such a weapon is already part of the U.S. nuclear arsenal. Developed and deployed during the Clinton Administration as a weapon against buried targets, the current nuclear earth penetrator (NEP) – the B61 Mod 11 – is a

[12] Department of Energy, "FY2006 Congressional Budget Request: National Nuclear Security Administration," DOE/ME-0046, Volume 1; Design began on a MPF in October 2002. Full-scale pit production from an MPF is not planned until 2021, at the earliest, with a production capacity of 125 pits per year to support stockpile requirements. Until the MPF is established, DoE will rely on a research facility at Los Alamos National Laboratory to fabricate a limited number of pits (10-20 per year), though this capability will not be available for several more years and will not be sufficient to maintain the stockpile.

[13] The Rocky Flats Plant (CO) used to produce pits, but that work was halted in 1989 due to safety concerns at the plant. For more detailed background information see: CRS, "Nuclear Weapons: The Reliable Replacement Warhead Program," March 24, 2005.

[14] Samuel W. Bodman, Secretary of Energy, in testimony before the Senate Armed Services Committee, February 15, 2005 (insert for the record).

[15] Such a weapon is typically a preexisting nuclear weapon with a modified casing to enable it to burrow into the ground.

[16] Proposed funding in the FY06 NNSA budget for the RNEP program is for an Air Force-led study. The decision to complete this study was reaffirmed with DoD in January 2005. In FY 2006, activities include conducting an impact test with a new, hardened casing on a mockup of the B83 warhead, analyzing the data from this impact test, and supporting integration meetings with the DoD. The study is scheduled for completion in FY07.

modification of the B-61 nuclear warhead which was retrofitted to give it earth penetrating capability. Pursuit of feasibility studies on a "robust" NEP (or RNEP) began because the B61-11 is not sufficiently hardened to penetrate certain target geologies. The RNEP feasibility study will determine whether a more robust outer casing – which still protects the internal components of the warhead – could be developed for the B83 warhead.

- **The United States is pursuing a number of capabilities to defeat hard and deeply buried targets.** The United States must not depend solely on nuclear capabilities to address hard and deeply buried targets. The U.S. military is pursuing a number of capabilities – conventional as well as RNEP – to provide policymakers with a range of options to address the target set.

- **Some targets cannot be defeated with anything other than an RNEP.** In testimony before the House Armed Services Committee, Secretary Rumsfeld noted that "new technology enables anyone in the world to buy dual-use technology and dig underground in rock twice the height of a basketball net and the full length of a basketball court every day. In rock. And it's available to anybody. *And countries all across the globe are putting things underground. And we have no capability, conventional or nuclear, to deal with the issue of deep penetrator*."[17]

- **DoD supports the RNEP study.** General Cartwright, Commander of U.S. Strategic Command, stated before the Senate Armed Services Subcommittee on Strategic Forces:
  - "We're going to have to have multiple ways by which we can hold [hard and deeply buried targets] at risk…The robust nuclear earth penetrator is one of several capabilities that I think will be necessary."[18]

  Secretary Rumsfeld stated before the Senate Armed Services Committee:
  - "The idea of proceeding with this study is just imminently sensible. And anyone would look back five years from now, if we failed to take a responsible step like that, and feel we'd made a mistake."[19]

Test Readiness

Test Readiness maintains unique underground nuclear test capabilities that are not supported in other stockpile stewardship programs.[20] As demonstrated by the stockpile stewardship program and the reliable replacement program, DoE is seeking alternatives to conducting nuclear tests that can still certify the reliability of the stockpile. Yet, the Test Readiness program is necessary to ensure the United States has the capability to test in a timely fashion, should it become necessary to certify the stockpile.

- **The United States must maintain the capacity to test in the event of an emerging crisis.** The initiative is intended to provide the U.S. government the ability to learn in a timely

[17] Donald Rumsfeld, Secretary of Defense, in testimony before the House Armed Services Committee, February 16, 2005 (emphasis added).
[18] General James E. Cartwright, Commander of U.S. Strategic Command, in testimony before the Senate Armed Services Subcommittee on Strategic Forces, April 4, 2005.
[19] Donald Rumsfeld, Secretary of Defense, in testimony before the Senate Armed Services Committee, February 17, 2005.
[20] Funds are requested to continue improving the state of readiness to reach an 18-month test-readiness posture in FY06.

fashion if there is a serious question about a warhead or to validate a proposed repair. In its FY00 Report to Congress, the Panel to Assess the Reliability, Safety, and Security of the United States Nuclear Stockpile recommended being able to return to testing within *three months to a year*, depending on the type of test.[21] The standard set during the 1990s was 24-36 months.[22] As John Foster, chairman of the Panel, has stated, "Prudence requires that every President have a realistic option to return to testing, should technical or political events make it necessary."[23]

- **Test Readiness ensures that the United States maintain qualified personnel that are able to conduct a test, if necessary.** As a number of long-term employees of DoE retire, it is crucial that a new generation of qualified personnel is in place to conduct a test, should it become necessary to ensure a safe, reliable, and credible nuclear infrastructure.

Congressional Support for Nuclear Initiatives is Critical

Congressional support of the above nuclear initiatives is critical to U.S. national security in the 21st century. Due to the technical complexity of the DoE initiatives, Congress cannot wait until a crisis in readiness and reliability is upon the United States – it will be too late. The DoE initiatives lay the ground work for a safe, reliable, and *credible* nuclear deterrent force for the 21st century. The attached Appendix includes the current legislative status of these initiatives as of the printing of this paper.

Conclusion

The United States must maintain its ability to deter current and future adversaries who would use nuclear weapons to threaten or attack the United States and its allies. U.S. nuclear deterrence in the 21st century must contend with a complex security environment – deterrent forces must be responsive in order to address major nuclear weapons states as well as states that achieve their nuclear ambitions.

Congress should support these initiatives to achieve and maintain a responsive nuclear infrastructure that can provide a deterrent force in the 21st century. Future U.S. adversaries – and even our allies – will continue to adapt and modernize their nuclear forces. Congress should pass funding for the requested nuclear initiatives in the Department of Energy FY06 Budget to maintain a responsive nuclear infrastructure as well.

[21] Panel to Assess the Reliability, Safety, and Security of the United States Nuclear Stockpile, "FY00 Report to Congress," February 1, 2001, p. 28-29.
[22] CRS, "Nuclear Weapons: Comprehensive Test Ban Treaty," updated May 17, 2005, pg. 3.
[23] John S. Foster, Chairman of the Panel to Assess the Reliability, Safety, and Security of the United States Nuclear Stockpile, in prepared testimony before the House Armed Services Committee, March 21, 2002.

Appendix

Legislative Status of DoE Initiatives

Reliable Replacement Warhead

The Reliable Replacement Warhead program replaced the Advanced Concepts Initiative per the FY05 Consolidated Appropriations Act (P.L. 108-447).[24] The FY06 DoE Budget Request includes $9.35 million for RRW, an increase of $422,000 from the amount appropriated in FY05 during the creation of the program.

- H.R. 1815, the FY06 National Defense Authorization Act (which provides the authorization for DoE's defense-related activities), as passed by the House on May 25, 2005, authorizes the full amount requested for RRW.
- H.R. 2419, the FY06 Energy and Water Development Appropriations bill (which funds most DoE functions), as passed by the House on May 24, 2005, includes $25 million for the RRW initiative, an increase of $15.65 million from the budget request. The additional funds are provided to accelerate the planning effort to initiate a competition among the NNSA weapons laboratories to develop the design for the RRW re-engineered and remanufactured warhead.
- S. 1042, the FY06 National Defense Authorization Act, as reported out of committee, authorizes the full amount requested for RRW.
- The Energy and Water Appropriations Bill, as passed by the Senate on July 1, 2005, provides an amount for the program similar to that provided by the House, that is $25.35 million, which is exactly $16 million over the requested level. [25]

Pit Manufacturing

In the FY06 DoE Budget Request, $248.76 million is included for Pit Manufacturing and Certification Campaign, a decrease of $14.26 million from the amount appropriated in FY05.[26] Items included in this amount are: Pit Manufacturing ($120.9 million); Pit Certification ($61.9 million); Pit Manufacturing Capability ($23.1 million); Modern Pit Facility ($7.7 million); and Pit Campaign Support Activities at the Nevada Test Site ($35.2 million).

- H.R. 1815 authorizes the amount requested for the Pit Manufacturing and Certification Campaign.
- H.R. 2419, as passed by the House, appropriates $241.1 million, including funding for all items except for the Modern Pit Facility.
- S. 1042, as reported, authorizes the amount requested for the Pit Manufacturing and Certification Campaign.

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[24] For background on previous funding for ACI and information on termination of the program in favor or RRW, see: CRS, "Nuclear Weapons: The Reliable Replacement Warhead Program," March 24, 2005.
[25] Senate Report 109-84 to accompany H.R. 2419, FY06 Energy and Water Appropriations Bill, p. 155. The amount remains unchanged after passage.
[26] For background on previous years funding for pit production and MPF, see: CRS, "Nuclear Warhead 'Pit' Production: Background and Issues for Congress," March 29, 2004; and CRS, "Energy and Water Development: FY2006 Appropriations," May 12, 2005.

- The Energy and Water Appropriations Bill, as passed by the Senate, funds the entire budget request amount for the Pit Manufacturing and Certification Campaign, specifically including appropriations for the Modern Pit Facility.[27]

Robust Nuclear Earth Penetrator

The FY06 DoE budget request includes $4.0 million for the RNEP study. DoD also requested $4.5 million in FY06 for RNEP, included in the Air Force budget, to study requirements for integrating the conceptual weapon on the B-2 platform. DoE projects another $14.0 million will be requested for FY2007, and then projects no further funds for the study.[28]

- H.R. 1815 deletes funding for DoE work on RNEP, but includes $4 million in Air Force, Research, Development, Test, and Evaluation "for a penetrator test that would evaluate the feasibility of various options for different types of penetrators that could hold HDBTs at risk."[29]
- H.R. 2419, as passed in the House, deletes all NNSA funds for RNEP; as the bill does not deal with DoD programs, it does not address the Air Force RNEP request.
- S. 1042, as reported, authorizes the amount requested for the DoE study, but does not fund the DoD Air Force portion of the study.
- The Energy and Water Appropriations Bill, as passed by the Senate, and consistent with the direction of the authorizers to date, funds the feasibility study to be conducted by NNSA.[30] In fact, the Senate specifically rejected an amendment designed to prohibit the use of funds for the RNEP study.[31]
- The Defense Appropriations bill, as reported out of committee, does not fund the Air Force integration study.

Test Readiness

In the FY06 DoE Budget Request, $25 million is included for Test Readiness under the Science Campaign, $1.8 million less than the amount appropriated in FY05.[32]

- H.R. 1815 authorizes the amount requested for Test Readiness.
- H.R. 2419 includes $15.0 million for Test Readiness. The House Appropriations Committee continues to oppose the 18-month readiness posture and, as noted, adds RRW to its rationale for that position.
- S. 1042 authorizes the amount requested for Test Readiness.
- The Energy and Water Appropriations Bill, as passed by the Senate, funds the entire budget request amount for the test readiness program.[33]

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[27] Senate Report 109-84 to accompany H.R. 2419, FY06 Energy and Water Appropriations Bill, p. 162-63. The amount remains unchanged after passage.

[28] For background on previous years funding for RNEP, see: CRS, "Robust Nuclear Earth Penetrator Budget Request and Plan, FY2005-FY2010," March 23, 2005.

[29] House Report 109-86 to accompany, H.R. 1815, the FY06 National Defense Authorization Act.

[30] Senate Report 109-84 to accompany H.R. 2419, FY06 Energy and Water Appropriations Bill, p. 155-56. The amount remains unchanged after passage.

[31] Senate Roll Call Vote No. 171 on S. Amdt. 1085 to H.R. 2419.

[32] For background on previous years funding for Test Readiness, see: CRS, "Nuclear Weapon Initiatives: Low-Yield R&D, Advanced Concepts, Earth Penetrators, Test Readiness (March 8, 2004), and CRS, "Energy and Water Development: FY2006 Appropriations," May 12, 2005.

Background on the Reliable Replacement Warhead Program

The purpose of the Reliable Replacement Warhead program is to demonstrate the feasibility of developing reliable replacement components for the existing nuclear stockpile. The initial focus will be to provide the cost and schedule for efficient replacement pits that can be certified *without* underground tests.[34]

Nuclear weapons are complex systems that undergo an "aging" process. The weapons are made of many different materials and components that may interact with air, moisture, and other compounds during manufacture, shipping, storage, and assembly. The elements also react with each other once they have been enclosed in the weapon. These reactions may cause the components within the weapon to weaken, harden, corrode, or even fail.[35]

As noted above, the shelf life of a nuclear weapon was not a major issue until the early 1990s when the United States ceased to develop and test nuclear weapons. Before that, new weapons featuring the latest technology were regularly designed and built.[36] When a new weapon entered the stockpile, an older one was generally retired. Now, new nuclear weapons are not being built, but existing weapons are expected to remain operational for many decades and perform exactly as designed if they must ever be used.

Nuclear weapons designed during the Cold War were designed with 'tight' performance margins. For example, a number of warheads built during the Cold War were designed to limit warhead weight and size for improved delivery. The tradeoff that occurred was a warhead with an expected service life of 20 years. This was an acceptable calculation since it was anticipated that the warhead would be replaced within that period of time by newer designs.[37] Since no new nuclear weapons are being made, DoE has required methods to ensure the safety, reliability, and performance of the aging nuclear weapons stockpile.

The DoE Stockpile Stewardship Program (SSP) uses different experiments and tools to obtain data relevant to nuclear warhead performance as components within a warhead potentially change properties with age. SSP then uses this data, as well as data from past nuclear tests, to scientifically simulate weapons performance. Routine surveillance monitors warheads for signs of actual or future deterioration. When problems are detected, knowledge gained through SSP is used to fix problems through the Life Extension Program (LEP).[38] Components that are not part of the nuclear explosive package within a warhead can incorporate advanced electronics or materials.

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[33] Senate Report 109-84 to accompany H.R. 2419, FY06 Energy and Water Appropriations Bill, p. 157. The amount remains unchanged after passage.
[34] Department of Energy, "FY2006 Congressional Budget Request: National Nuclear Security Administration," DOE/ME-0046, Volume 1.
[35] Lawrence Livermore National Laboratory, "A Better Picture of Aging Materials," *Science and Technology Review*, September 1999. Available at: http://www.llnl.gov/str/09.99.html.
[36] Lawrence Livermore National Laboratory, "A Better Picture of Aging Materials," *Science and Technology Review*, September 1999. Available at: http://www.llnl.gov/str/09.99.html.
[37] Ambassador Linton F. Brooks, Administrator of the National Nuclear Security Administration, in testimony before the Senate Armed Services Subcommittee on Strategic Forces, on April 4, 2005.
[38] CRS, "Nuclear Weapons: The Reliable Replacement Warhead Program," March 24, 2005.

However, due to the U.S. moratorium on nuclear testing, LEP seeks to replicate original components within the nuclear explosive package of a warhead.[39] The RRW program would benefit stockpile reliability by utilizing new technologies to produce advanced replacement components as opposed to replicating original components.

Knowledge gained from the SSP and the RRW program could allow policymakers the option to replace warheads designed during the Cold War with more reliable designs with the same capability. The tight constraints of weight and size could be relaxed in favor of a warhead that is reliable with a longer service life. Lessons learned under SSP make this possible. Without such measures, the aging process will continue increasing the likelihood that degradation of components in the weapons will result in DoE being unable to certify the safety, security, and reliability of the current stockpile in the future.

[39] CRS, "Nuclear Weapons: The Reliable Replacement Warhead Program," March 24, 2005.